



DEPARTMENT of ENVIRONMENT  
and NATURAL RESOURCES

JOE FOSS BUILDING  
523 EAST CAPITOL  
PIERRE, SOUTH DAKOTA 57501-3182

denr.sd.gov

**RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT  
APPLICATION NO. 8096-3, Jeffrey Aman**

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Program, Department of Environment and Natural Resources concerning Water Permit Application No. 8096-3, Jeffrey Aman, 33723 125<sup>th</sup> Street, Hosmer SD 57448.

The Chief Engineer is recommending APPROVAL of Application No. 8096-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) it is in the public interest with the following qualifications:

1. The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
2. The well authorized by Permit No. 8096-3 shall be constructed by a licensed well driller and construction of the well and installation of the pump shall comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) pursuant to Section 74:02:04:28.
3. This Permit is approved subject to the irrigation water use questionnaire being submitted each year.

See report on application for additional information.

Jeanne Goodman, Chief Engineer  
March 27, 2015

NOTE: The Grand Aquifer may have a high salinity hazard and a medium sodium hazard. DENR encourages you to have a soil water compatibility analysis performed to insure the water is suitable for irrigation. The Water Resources Institute at SDSU or other qualified soil scientist can assist you in making a soil water compatibility determination and recommend if there are water management techniques to implement to optimize crop production and protect the soil structure.

**REPORT TO THE CHIEF ENGINEER  
WATER PERMIT APPLICATION NOS. 8096-3 AND 8097-3  
JEFFREY AMAN  
MARCH 9, 2015**

Water Permit Application No. 8096-3 proposes to appropriate water from the Grand aquifer in McPherson County at maximum diversion rates of 2.28 cubic feet per second (cfs). Water Permit Application No. 8096-3 proposes to construct a single well located in the SE  $\frac{1}{4}$  NW  $\frac{1}{4}$  of Section 8, T125N-R72W to supply the proposed diversion rate. The well is expected to be completed at a depth of approximately 270 feet below ground surface and will be used to irrigate 160 acres in the NW  $\frac{1}{4}$  of Section 8, T125N-R72W of McPherson County.

Water Permit Application No. 8097-3 proposes to appropriate water from the Grand aquifer in Edmunds County at maximum diversion rates of 2.67 cubic feet per second (cfs). Water Permit Application No. 8097-3 proposes to construct a single well located in the center of the NE  $\frac{1}{4}$  of Section 7, T124N-R72W to supply the proposed diversion rate. The well is expected to be completed at a depth of approximately 340 feet below ground surface and will be used to irrigate 140 acres in the NE  $\frac{1}{4}$  and 140 acres in the SW  $\frac{1}{4}$  of Section 7, T124N-R72W of Edmunds County.

**AQUIFER: Grand aquifer (G)**

**GEOLOGY AND AQUIFER CHARACTERISTICS:**

The Grand aquifer consists of glacial outwash and alluvium from the ancient Grand River (Koch, 1970) and underlies portions of six counties in South Dakota with an approximate area of 405,100 acres. There are an estimated 3,637,000 acre feet (ac-ft) of recoverable water in storage in the Grand aquifer (Hedges and others, 1982). The Grand aquifer is hydraulically connected to Lake Oahe, causing water levels in the aquifer to fluctuate with reservoir levels in the vicinity of Lake Oahe. Flow within the aquifer is generally to the west and towards the Missouri River. The top of the aquifer generally ranges from 150 to 300 feet below ground surface and has an average thickness of approximately 100 feet (Koch, 1970).

Test hole data submitted with Water Permit Application Nos. 8096-3 and 8097-3 indicate permeable material is encountered at 50 and 160 feet below ground surface and is approximately 80 and 180 feet thick at the respective proposed well locations. The proposed well location in Water Permit Application No. 8097-3 is within one quarter mile of Hamilton's (1974) delineation of the boundaries of the Grand aquifer. However, the proposed well site in Water Permit Application No. 8096-3 is approximately 1.5 miles to the north of the established boundaries of the Grand aquifer delineated by Hamilton (1974) and shown in Figure 1. The static water level reported for the test hole in Water Permit Application No. 8096-3 is consistent with those of observation wells completed into the Grand aquifer, and the presence of shale directly below the water bearing material makes it a basal aquifer, of which the Grand aquifer is the only one in the area. It follows that the water bearing material that Water Permit Application No. 8096-3 proposes to divert from is the Grand aquifer.

Supplemental information submitted with the two water permit applications along with data from nearby Observation Well ED-80A (Water Rights, 2015a) show the aquifer is under unconfined conditions at the proposed well site in Water Permit Application No. 8096-3 and confined conditions at the well site proposed in 8097-3. Unconfined conditions are the exception in the Grand aquifer as confined conditions are more common. In most locations, the Grand aquifer has a high salinity hazard and a medium sodium hazard, requiring special management practices for irrigation (Koch, 1970). The water quality at this location is unknown.

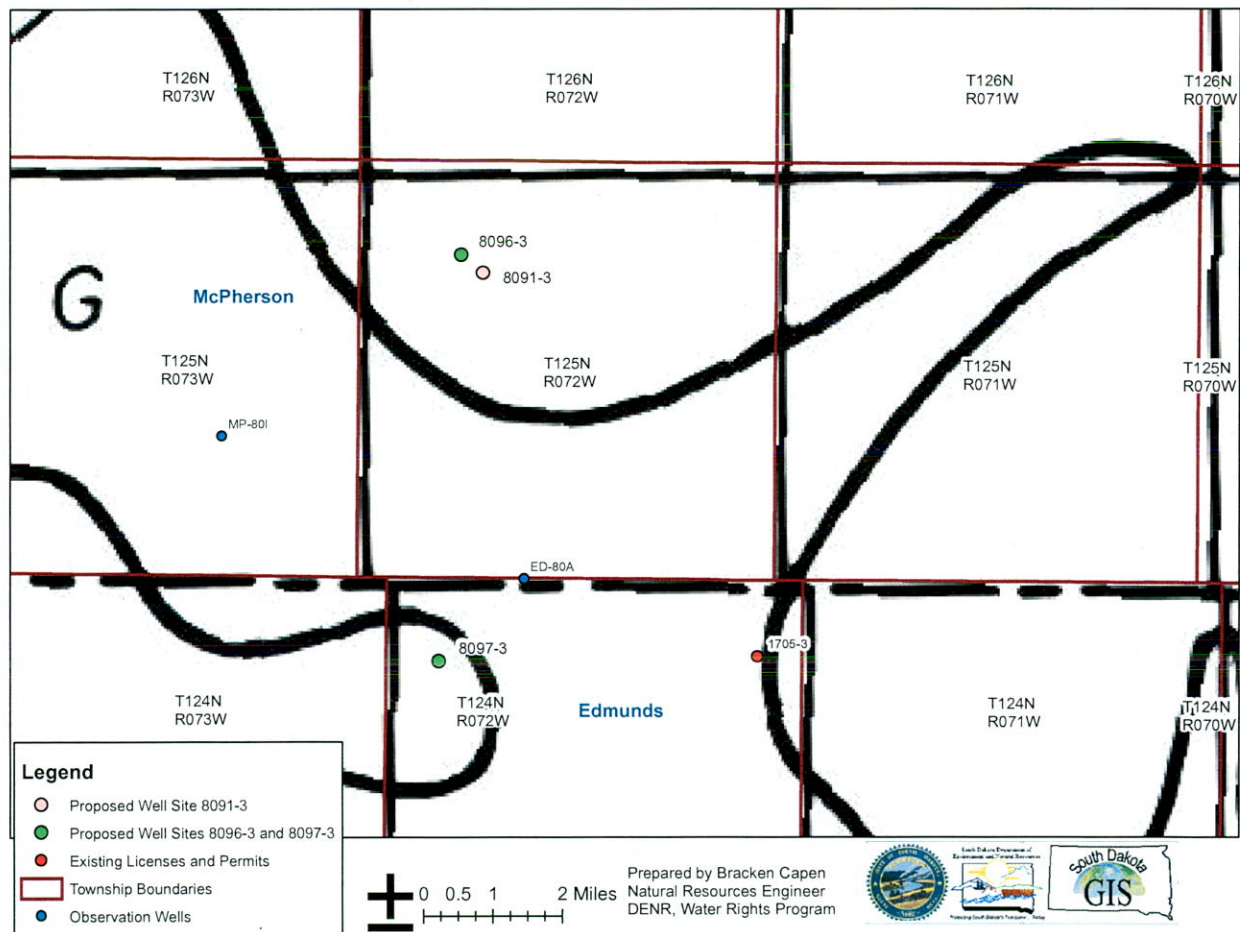


Figure 1: Extent of the Grand aquifer (Hedges and others, 1982) modified to include existing water rights, proposed well sites, and observation well locations (Water Rights 2015a).

#### SDCL 46-2A-9:

Pursuant to SDCL 46-2A-9, a permit to appropriate water may be issued only if there is a reasonable probability that there is unappropriated water available for the applicant's proposed use, that the proposed diversion can be developed without unlawful impairment of existing rights and that the proposed use is a beneficial use and in the public interest. This report will address the availability of unappropriated water and existing rights from the Grand aquifer that are pertinent to this application.

## **WATER AVAILABILITY:**

The probability of unappropriated water available from an aquifer can be evaluated by considering SDCL 46-6-3.1, which requires “No application to appropriate groundwater may be approved if, according to the best information reasonably available, it is probable the quantity of water withdrawn annually from a groundwater source will exceed the quantity of the average estimated annual recharge of water to the groundwater source.” If the source of the water is older or lower than the Greenhorn Formation and a public water system has applied for a permit, the Board need not consider the recharge/withdrawal issue. Here, a public water system is not involved. Therefore, withdrawal/recharge issue must be considered.

In applying SDCL 46-6-3.1, the Sixth Judicial Circuit Court ruled in 2005 that if the Water Management Board uses average annual recharge, then it should also use average annual withdrawals to determine if unappropriated water is available from the aquifer (*Hines v. South Dakota Dept. of Environ. and Nat'l. Resources, Hughes County 04-37*) (Memorandum Decision, April 29, 2005).

A 2012 First Judicial Circuit Court’s rulings basically stated that data must be presented to show it is probable the average annual recharge exceeds the average annual discharge by at least the amount requested by the water permit application being considered (*Hanson County Dairy v. Robert Bender and Stace Nelson*) (Memorandum Decision, April 11, 2012).

Later in 2012, the First Judicial Circuit Court stated that in deciding whether or not it is probable that the quantity of water withdrawn will exceed the quantity of the average estimated annual recharge is to be based according to the best information reasonably available, and that nothing in South Dakota law requires a recharge study (*Longview Farms, LLP v. South Dakota Dept. of Environ. and Nat'l. Resources*), (Memorandum Decision, May 17, 2012).

### *Recharge:*

Recharge to the Grand aquifer comes in the form of infiltration of precipitation through overlying sediments and from subsurface inflow from adjacent areas (Koch, 1970). The Grand aquifer may also receive recharge from the Missouri River during periods of high flow and stage. According to Hedges and others (1982), recharge to unconfined portions of the Grand aquifer is approximately 4.0 inches per year. However, since unconfined conditions are the exception, for the purposes of this application, it is conservatively assumed that the entire aquifer is confined. Hedges and others (1985) concluded that the recharge rate to confined aquifers in the region ranges from 0.15 to 0.60 inches per year. Using the area defined above by Hedges and others (1982) of 405,100 acres, the range of rates for confined aquifers equates to 5,064 to 20,255 ac-ft/yr of recharge in the Grand.

### *Discharge:*

Discharge from the Grand aquifer occurs due to outflow to adjacent subsurface areas, to the Missouri River during periods of low flow and stage, and well withdrawals (Koch, 1970). Currently, there are 49 water rights/permits authorizing wells to withdraw water from the Grand aquifer (Water Rights, 2015b). There are also a number of domestic wells on file with the Water Rights Program that are known to be completed into the Grand aquifer (Water Rights, 2015d). However, domestic water use is small compared to the use associated with water rights/permits

from the aquifer and, consequently, will not be taken into consideration in the water balance estimates for the aquifer.

In instances when volumes have not been reported, the amount of water used by non-irrigation water rights/permits in the aquifer is estimated assuming that those which are limited by diversion rate will pump at that rate 60 percent of the time, and those limited by volume will divert that entire volume annually. Estimated annual water use by non-irrigation water users is shown in Table 1. Municipal water rights, with the exception of Roscoe, are not included in this table as their water supply currently comes from WEB Rural Water with their own pump systems generally used for backup in case of system failure (Drinking Water, 2015).

Table 2 shows historic and average irrigation water use from the Grand aquifer over the period of 1979-2013. Based on irrigation questionnaire data, the average irrigation use over this time period is 2171.1 ac-ft/yr. However, the number of water permits/rights reporting irrigation use in 2013 was 50 percent above the historic average (Water Rights, 1980-2014). Historically, the ratio of water pumped annually compared to the appropriation rate from the Grand aquifer has been approximately 15 percent over the period of record. Although there has been a recent increase in the number of water permits/rights pumping from the Grand aquifer, and a corresponding increase in the reported annual volume pumped, the ratio of pumped to appropriated water increased in 2012 and 2013 to about 23 percent. Although the level of development is not expected to decrease, the average rate of pumping to appropriation rate is expected to remain relatively consistent with the historic norm. Applying this historic average (15 percent) to the current level of appropriation (17,107.4 ac-ft/yr) produces an expected rate of withdrawal for irrigation purposes of approximately 3,167.6 ac-ft/yr. Given the current level of development in the region, this rate is assumed to be more representative of expected future irrigation withdrawals from the Grand aquifer than the average rate of withdrawal over the period of record.

Permit No.	Name	County	Status	Type	CFS	Ac-ft
*778-3	Town of Pollock	CA	LC	MUN	0.56	
*1705-3	City of Hosmer	ED	LC	MUN	0.27	
*2769-3	Town of Onaka	FA	LC	MUN	0.13	
*3947A-3	City of Faulkton	FA	LC	MUN	0.27	
*3947B-3	City of Faulkton	FA	LC	MUN	0.73	
*3998-3	Town of Glenham	WL	LC	MUN	0.12	
*4144-3	Town of Mound City	CA	LC	MUN	0.22	
4914-3	City of Roscoe	ED	LC	MUN	0.5	9.2
*5366-3	Town of Pollock	CA	LC	MUN	0.78	
*5417-3	City of Herreid	CA	LC	MUN	1.17	
6012-3	Jensen's W Pollock Resort	CA	LC	COM	0.035	15.2
6111-3	Blumengard Colony	FA	LC	COM/LCO	0.45	195.5
6185-3	Blumengard Colony	FA	LC	COM/DOM/LCO	0.667	289.7
6629-3	Bret & Raechel Flihs	FA	LC	COM/DOM/LCO	0.4	173.8
7184-3	Jensen Rock and Sand Inc.	CA	PE	IND	0.67	20
7841-3	Herreid Concrete, Inc.	CA	PE	IND	1.56	**27
				<b>Total</b>	<b>=</b>	<b>703.4</b>
*= Primary water source is WEB Rural Water (Drinking Water, 2015)						
**= Water Rights, 2015c						
CA= Campbell, ED= Edmunds, FA= Faulk, WL= Walworth, LC= Water Right, PE= Water Permit						
MUN= Municipal, COM= Commercial, LCO= Livestock Confinement Operation, Dom= Domestic, IND= Industrial						

Table 1- Non-irrigation water rights/permits diverting water from the Grand aquifer (Water Rights, 2015b)

*Water Balance:*

Including non-irrigation water rights/permits, the average annual rate of withdrawal from the Grand aquifer over the period of record has been estimated to be 2,901.5 ac-ft/yr (Water Rights, 1980-2014; Water Rights, 2015b). If the number of water permits/rights in 2013 is seen as more representative of the future of the region, the average rate of withdrawal is expected to increase to approximately 3,870 ac-ft/yr. Both these withdrawal rates are below the range of possible recharge rates presented by Hedges and others (1982). Therefore, there is a reasonable probability that unappropriated water is available from the Grand aquifer for the use proposed in Water Permit Application Nos. 8096-3 and 8097-3.

<b>Year</b>	<b>No. of Permits Reporting</b>	<b>Appropriation (ac-ft/yr)</b>	<b>Pumpage Reported (ac-ft/yr)</b>
1979	22	18382	1339
1980	21	17902	2334
1981	28	20782	2204
1982	22	16223.6	2956.4
1983	22	17681.6	3067.58
1984	25	19401.6	3407
1985	23	18441.6	3082
1986	22	18121.6	2333
1987	22	18121.6	2272
1988	20	16645.6	2845.9
1989	20	16645.6	2042.1
1990	20	16645.6	2335
1991	20	16645.6	1853
1992	19	15632.6	1205
1993	18	13760.6	727
1994	17	13370.6	1695.41
1995	16	12890.6	1092.56
1996	15	11394.6	1172.04
1997	15	11394.6	1422
1998	15	11394.6	1245.11
1999	15	11394.6	1162.69
2000	16	10797.6	1317.81
2001	16	10797.6	1220.14
2002	17	11061.6	2645.99
2003	17	11061.6	1784.86
2004	17	11061.6	1621.84
2005	18	11701.6	1842.92
2006	20	11653.6	3892.62
2007	19	12163.4	2352.04
2008	19	12163.4	2660.37
2009	19	12163.4	2334.9
2010	19	12163.4	2903.84
2011	21	13219.4	2428.52
2012	23	13755.4	3206.33
2013	30	17107.4	3983.22
<b>Max</b>	<b>30</b>	<b>20782</b>	<b>3983.22</b>
<b>Min</b>	<b>15</b>	<b>10797.6</b>	<b>727</b>
<b>Average</b>	<b>20</b>	<b>14392.68</b>	<b>2171.09</b>

Table 2- Historic irrigation water use from the Grand aquifer (Water Rights, 1980-2014)

### Observation Well Data:

Administrative Rule of South Dakota Section 74:02:05:07 requires that “the [Water Management Board] shall rely upon the record of observation well measurements... to determine that the quantity of water withdrawn annually from the aquifer does not exceed the estimated average annual recharge of the aquifer.”

The DENR-Water Rights Program monitors 36 observation wells in the Grand aquifer. Of these wells, Observation Well ED-80A is the closest to the proposed well site proposed in Water Permit Application No. 8097-3 at approximately 1.75 miles to the northeast. The closest observation well to the well site proposed in Water Permit Application No. 8096-3 is MP-80I at 4.25 miles to the southwest. Hydrographs for Observation Wells ED-80A and MP-80I are shown in Figures 2 and 3 and record the visible effects of pumping in water levels that are primarily climatically controlled. Since these observation wells were constructed in 1980, water levels in both have increased by at least three feet (Water Rights, 2015a). Thirty four of the 36 observation wells completed into the Grand aquifer (including the two nearest the proposed well sites) show increasing trend lines, indicating an increase in the amount of water in storage over the period of record. More directly, climatic conditions mask temporal effects, indicating natural recharge and discharge eclipse anthropogenic discharge in the aquifer. Therefore, unappropriated water is available for the proposed use.

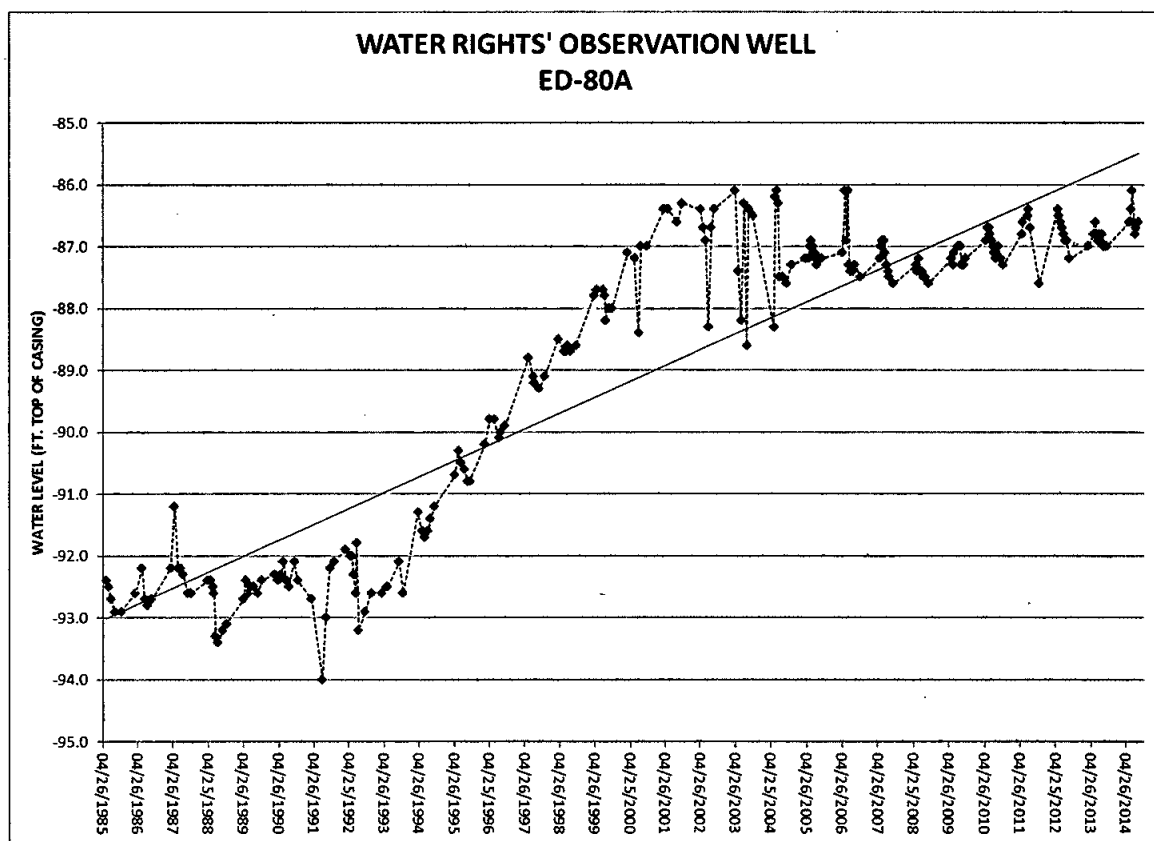


Figure 2: Historic water levels in Observation Well ED-80A (Water Rights, 2015a)



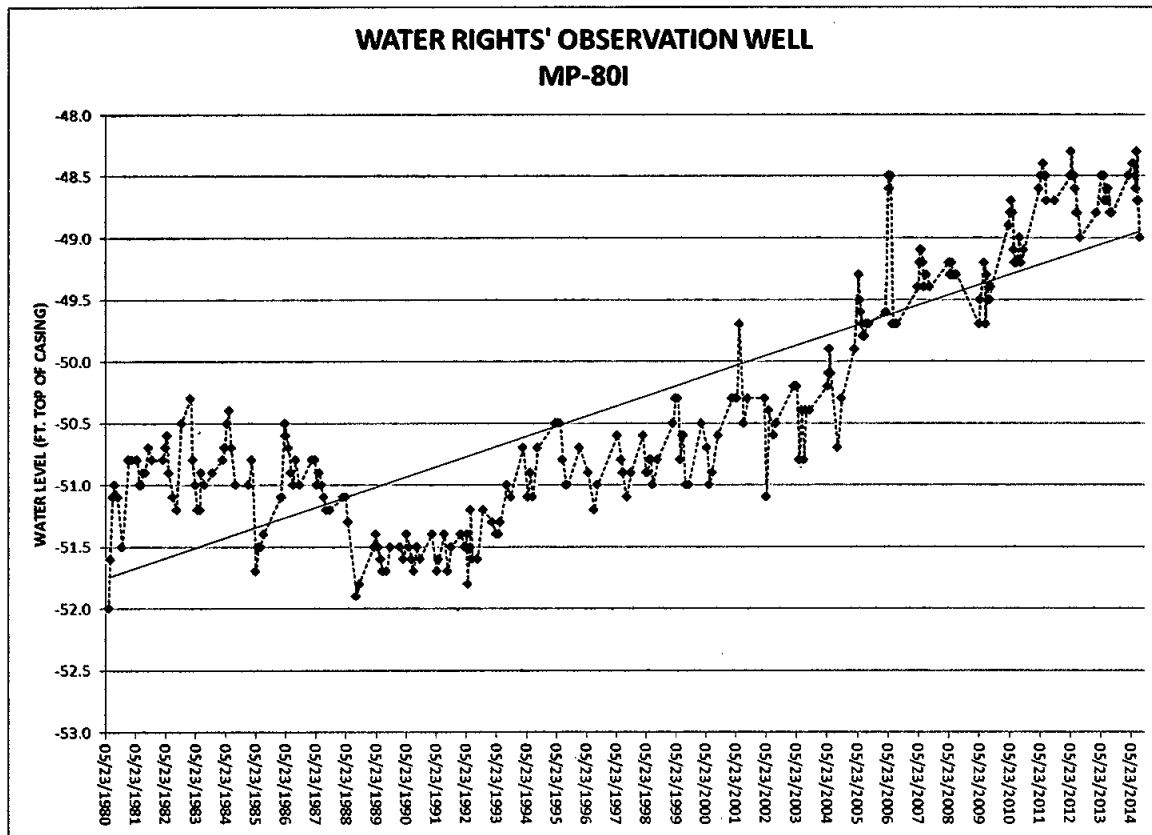


Figure 3: Historic water levels in Observation Well MP-80I (Water Rights, 2015a)

Of the two observation wells that see declining trend lines in water levels over the period of record, water levels in Observation Well ED-2000A are 150 feet lower than water levels in nearby Observation Wells FA-2000A and FA-80A, located two and three miles to the east, respectively. Water levels in ED-2000A are not assumed to represent the Grand aquifer.

The other observation well completed into the Grand aquifer that shows declining water levels over the period of record is Observation Well CA-80A. Declining water levels in CA-80A appear to be the result of increased local pumping since 2005 (see Figure 4). Water levels have fully recovered annually but have also experienced record drawdown during irrigation season since that time. Since full annual recovery has occurred each year since 2005, the declining trend line is assumed to be the result of local pumping and not of declining water levels overall.

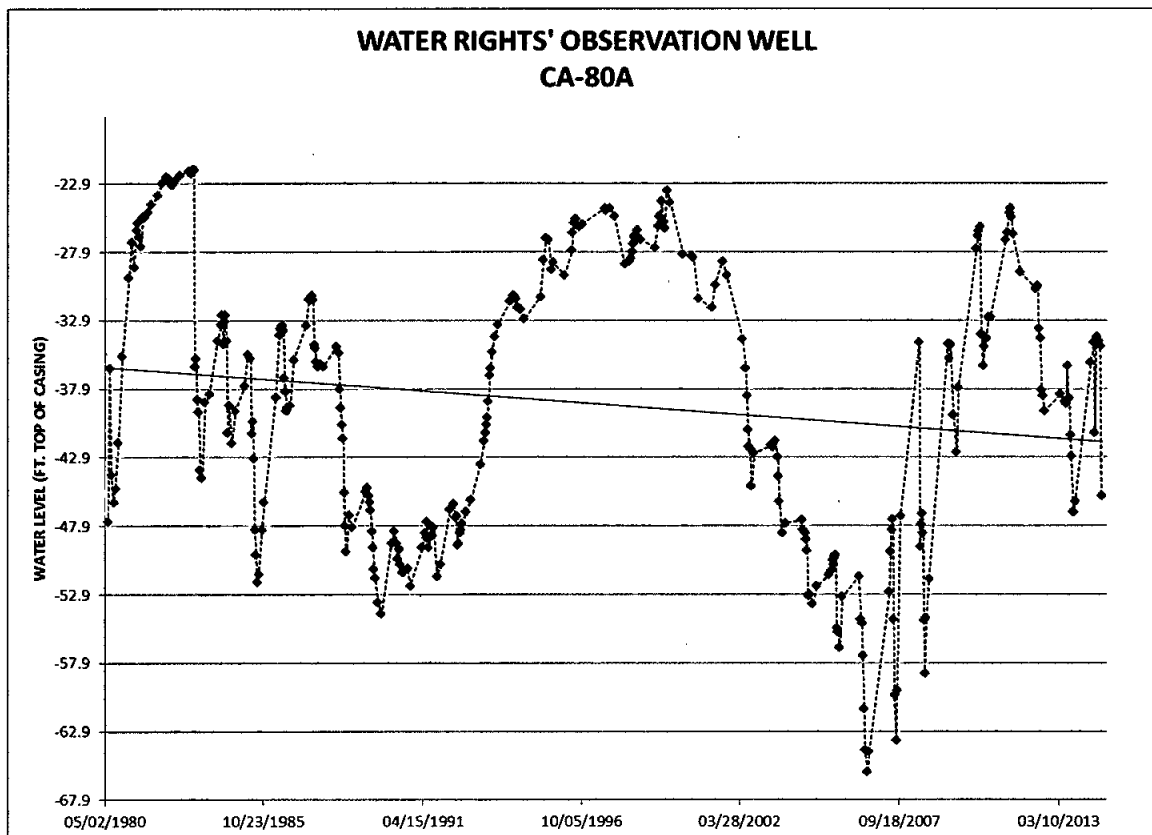


Figure 4: Historic water levels in Observation Well CA-80A (Water Rights, 2015a)

#### EXISTING WATER RIGHTS:

There are no existing water rights or permits appropriating water from the Grand aquifer within four miles of the proposed well sites (Water Rights, 2015b). Interference with water rights/permits more than four miles from the proposed well sites is not expected to occur given the distance involved. However, at the time this report was written, another water permit application (8091-3) was submitted, proposing to construct a production well approximately 0.33 miles to the southeast of the well site proposed in Application No. 8096-3. Although this well has not yet been constructed and may not be constructed prior to the completion of the proposed irrigation systems in Water Permit Application No. 8096-3, it will bear an earlier priority date than 8096-3 because of its prior submission. Koch (1970) established a transmissivity in the Grand aquifer in Campbell County of 100,000 gallons per minute per day (GPM/day). Assuming Koch's (1970) transmissivity value applies to the Grand aquifer in McPherson and Edmunds Counties as well as Campbell County, and that both wells are completed into material with a conservative storativity value of 0.001, drawdown of water levels at the well site proposed by Application No. 8091-3 as a result of pumping under 8096-3 would not exceed two feet. This drawdown assumes approximately one ac-ft/yr of water would be applied to each irrigated acre. This amount is not expected to be sufficient to cause unlawful interference.

The Water Rights Program is aware of domestic wells located approximately 1.6 miles to the southeast and 1.75 miles to the north of the proposed well sites in Water Permit Application Nos. 8096-3 and 8097-3, respectively. Using the characteristics described above, the calculated drawdown at a distance greater than 1.5 miles from the production wells as a result of applying

one ac-ft/yr to each irrigated acre over half a year is less than two feet in the case of 8097-3 and less than one foot in the case of 8096-3. Assuming all domestic wells within the radius of influence are adequately constructed, this level of drawdown is not expected to adversely impair any existing nearby domestic wells on file with the Water Rights Program.

Wells supplying existing water rights/permits and domestic uses are protected from adverse impacts per Water Management Board rules 74:02:04 and 74:02:05, which were promulgated pursuant to SDCL 46-6-6.1. These rules provide for the regulation of large capacity wells to the degree necessary to maintain an adequate depth of water for a prior appropriator in wells that have the ability to produce water **independent of artesian pressure**. Simply put, the pump placement in a prior appropriator's well is not necessarily protected.

If the water levels in the Grand aquifer were to decline, owners of existing wells bear the responsibility of lowering the pump inlet in the well to the top of the aquifer, if necessary. Increased lift would decrease the pump discharge; or require a larger pump or a different type of a pump to maintain the same output.

An increase in operating expenses that may result from interference between wells is not necessarily an adverse impact. The Water Management Board considered this situation in the matter of Water Permit Application 2313-2, Coca-Cola Bottling Company of the Black Hills (Water Rights, 1995). The Board adopted findings of fact and conclusions of law that basically state that if the increased cost or decreased production is considered an adverse impact, it could be in conflict with SDCL 46-1-4, which requires South Dakota's water resources to be put to beneficial use to the fullest extent of which they are capable.

#### CONCLUSIONS:

1. Water Permit Application Nos. 8096-3 and 8097-3 propose to withdraw groundwater at a maximum diversion rate of 2.28 and 2.67 cfs, each from one well to be completed into the Grand aquifer in McPherson and Edmunds Counties for the irrigation of 160 and 280 acres, respectively.
2. There is a reasonable probability that unappropriated water is available from the Grand aquifer to supply the proposed appropriations.
3. The proposed wells are not expected to adversely impair nearby adequate wells.



Bracken Capen  
SD DENR-Water Rights Program

Approved by,



Ken Buhler  
SD DENR-Water Rights Program

## REFERENCES:

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